



## **A Generalized Framework for Different Drought Indices: Testing its Suitability in a Simulation of the last two Millennia for Europe**

Christoph C. Raible (1,2), Oliver Baerenbold (1,2,3), Juan Jose Gomez-Navarro (1,2)

(1) University of Bern, Physics Institute, Climate and Environmental Physics, Bern, Switzerland (raible@climate.unibe.ch),  
(2) University of Bern, Oeschger Centre for Climate Change Research, Bern, Switzerland , (3) now at University of Basel,  
Schweizerisches Tropen- und Public Health-Institut, Basel, Switzerland

Over the past decades, different drought indices have been suggested in the literature. This study tackles the problem of how to characterize drought by defining a general framework and proposing a generalized family of drought indices that is flexible regarding the use of different water balance models. The sensitivity of various indices and its skill to represent drought conditions is evaluated using a regional model simulation in Europe spanning the last two millennia as test bed.

The framework combines an exponentially damped memory with a normalization method based on quantile mapping. Both approaches are more robust and physically meaningful compared to the existing methods used to define drought indices. Still, framework is flexible with respect to the water balance, enabling users to adapt the index formulation to the data availability of different locations.

Based on the framework, indices with different complex water balances are compared with each other. The comparison shows that a drought index considering only precipitation in the water balance is sufficient for Western to Central Europe. However, in the Mediterranean temperature effects via evapotranspiration need to be considered in order to produce meaningful indices representative of actual water deficit. Similarly, our results indicate that in north-eastern Europe and Scandinavia, snow and runoff effects needs to be considered in the index definition to obtain accurate results.